<u>IN THE CLAIMS</u>:

Claims 1, 2, 12, 16, 20, 21, 23, and 25 have been amended, claims 26-30 have been added, and claims 19 and 22 have been canceled herein. All claims currently pending and under consideration are shown below. Please enter these claims as amended. This listing of claims will replace all prior versions and listings of claims in the application.

<u>Listing of Claims</u>:

1. (currently amended) A method for encoding a digital image by rate-distortion adaptive zerotree-based residual vector quantization comprising:
obtaining a digital image;
transforming said digital image into <u>a</u> wavelet domain, thereby generating a pyramid hierarchy;
losslessly encoding a top low-low subband of said pyramid hierarchy, thereby obtaining a losslessly encoded portion of said digital image;
vector quantization (VQ) encoding all other subbands of said pyramid hierarchy, based on a zerotree insignificance prediction, thereby obtaining a lossy encoded portion of said digital image; and
outputting an encoded image from said losslessly encoded portion of said digital image and said lossy encoded portion of said digital image.

2. (currently amended) The method of claim 1, wherein said transforming said digital image into <u>the</u> wavelet domain comprises a 2-dimensional separable octave decomposition which generates said pyramid hierarchy.

3. (original) The method of claim 1, wherein said transforming comprises a Daubechies 9-7 symmetric wavelet transform.

4. (original) The method of claim 1, wherein said transforming comprises a Two Six wavelet transform.

5. (original) The method of claim 1, wherein said transforming comprises a Two Ten wavelet transform.

6. (original) The method of claim 1, wherein said losslessly encoding a top LL subband comprises differential pulse coded modulator and Huffman coding.

7. (original) The method of claim 1, wherein said losslessly encoding a top LL subband comprises differential pulse coded modulator and universal source coding.

8. (original) The method of claim 1, wherein said losslessly encoding a top LL subband comprises differential pulse coded modulator and arithmetic coding.

9. (original) The method of claim 1, wherein said VQ encoding comprises rate-distortion optimization along a threshtree.

10. (original) The method of claim 1, wherein said VQ encoding includes targeted rate control.

11. (original) A method for decoding an image encoded by rate-distortion adaptive zerotree-based residual vector quantization, comprising:

obtaining said encoded image;

reconstructing a zerotree from said encoded image;

vector quantization decoding subbands in said encoded image other than a top LL subband;

losslessly decoding said top LL subband;

reverse wavelet transforming said top LL subband and said vector quantization decoded subbands; and

outputting a decoded image from said decoded top LL subband and said decoded subbands other than said decoded top LL subband.

12. (currently amended) A method for transmitting a digital image across a communications channel comprising:

obtaining a digital image;

transforming said digital image into a wavelet domain, thereby generating a pyramid hierarchy;

losslessly encoding a top low-low subband of said pyramid hierarchy, thereby obtaining a losslessly encoded portion of said digital image;

vector quantization (VQ) encoding all other subbands of said pyramid hierarchy, based on a zerotree insignificance prediction, thereby obtaining a lossy encoded portion of said digital image;

outputting an encoded image from said losslessly encoded portion of said digital image and said lossy encoded portion of said digital image;

transmitting said encoded image along a communications channel;

obtaining said encoded image transmitted along said communications channel;

reconstructing a zerotree from said encoded image;

vector quantization decoding subbands in said encoded image other than a top LL subband;

losslessly decoding said top LL subband;

reverse wavelet transforming said top LL subband and said vector quantization decoded subbands; and

outputting a decoded image from said decoded top LL subband and said decoded subbands other than said decoded top LL subband.

13. (original) The method of claim 12, wherein said transforming comprises a wavelet transform selected from the group comprising a Daubechies 9-7 symmetric wavelet transform, a Two Six wavelet transform and a Two Ten (TT) wavelet transform.

14. (original) The method of claim 12, wherein said losslessly encoding a top LL subband comprises differential pulse coded modulator and Huffman coding.

15. (original) The method of claim 12, wherein said losslessly encoding a top LL subband comprises Universal source coding.

16. (currently amended) An integrated circuit for implementing a method for encoding a digital image by rate-distortion adaptive zerotree-based residual vector quantization, said method comprising:

obtaining a digital image;

transforming said digital image into a wavelet domain, thereby generating a pyramid hierarchy;

losslessly encoding a top low-low subband of said pyramid hierarchy, thereby obtaining a losslessly encoded portion of said digital image;

vector quantization (VQ) encoding all other subbands of said pyramid hierarchy, based on a zerotree insignificance prediction, thereby obtaining a lossy encoded portion of said digital image; and

outputting an encoded image from said losslessly encoded portion of said digital image and said lossy encoded portion of said digital image.

17. (original) The integrated circuit of claim 16, wherein said transforming comprises a wavelet transform selected from the group comprising a Daubechies 9-7 symmetric wavelet transform, a Two Six wavelet transform and a Two Ten (TS) wavelet transform.

18. (original) An integrated circuit for implementing a method for decoding a digital image that has been encoded by rate-distortion adaptive zerotree-based residual vector quantization, said method comprising:

obtaining said encoded image;

reconstructing a zerotree from said encoded image;

vector quantization decoding subbands in said encoded image other than a top LL subband;

losslessly decoding said top LL subband;

reverse wavelet transforming said top LL subband and said vector quantization decoded subbands; and

outputting a decoded image from said decoded top LL subband and said decoded subbands other than said decoded top LL subband.

19. (canceled)

20. (currently amended) ~~The~~ An integrated circuit for coding and decoding an image~~of claim 19~~, wherein said coding comprises:

transforming said digital image into a wavelet domain, thereby generating a pyramid hierarchy;

losslessly encoding a top low-low subband of said pyramid hierarchy, thereby obtaining a losslessly encoded portion of said digital image;

vector quantization (VQ) encoding all other subbands of said pyramid hierarchy, based on a zerotree insignificance prediction, thereby obtaining a lossy encoded portion of said digital image; and

outputting an encoded image from said losslessly encoded portion of said digital image and said lossy encoded portion of said digital image.

21. (currently amended) The integrated circuit of claim ~~19~~ 20, wherein said decoding comprises:

~~reconstructing a zerotree from an encoded image;~~

reconstructing a zerotree from said encoded image;

vector quantization decoding subbands in said encoded image other than a top LL subband;

losslessly decoding said top LL subband;

reverse wavelet transforming said top LL subband and said vector quantization decoded subbands; and

outputting a decoded image from said decoded top LL subband and said decoded subbands other than said decoded top LL subband.

22. (canceled)

23. (currently amended) ~~The~~ A circuit card for implementing a method for encoding and decoding an image~~of claim 22~~, wherein said circuit card comprises circuitry configured for:
obtaining a digital image;
transforming said digital image into a wavelet domain, thereby generating a pyramid hierarchy;
losslessly encoding a top low-low subband of said pyramid hierarchy, thereby obtaining a losslessly encoded portion of said digital image;
vector quantization (VQ) encoding all other subbands of said pyramid hierarchy, based on a zerotree insignificance prediction, thereby obtaining a lossy encoded portion of said digital image; and
outputting an encoded image from said losslessly encoded portion of said digital image and said lossy encoded portion of said digital image.

24. (original) The circuit card of claim 23, wherein said circuit card further comprises circuitry configured for:
obtaining said encoded image;
reconstructing a zerotree from said encoded image;
vector quantization decoding subbands in said encoded image other than a top LL subband;
losslessly decoding said top LL subband;
reverse wavelet transforming said top LL subband and said vector quantization decoded subbands; and
outputting a decoded image from said decoded top LL subband and said decoded subbands other than said decoded top LL subband.

25. (currently amended) A system for transmitting an image over a communications channel, wherein said system implements a method for encoding, transmitting and decoding a digital image by rate-distortion adaptive zerotree-based residual vector quantization, said method comprising:

obtaining a digital image;

transforming said digital image into a wavelet domain, thereby generating a pyramid hierarchy;

losslessly encoding a top low-low subband of said pyramid hierarchy, thereby obtaining a losslessly encoded portion of said digital image;

vector quantization (VQ) encoding all other subbands of said pyramid hierarchy, based on a zerotree insignificance prediction, thereby obtaining a lossy encoded portion of said digital image;

outputting an encoded image from said losslessly encoded portion of said digital image and said lossy encoded portion of said digital image;

transmitting said encoded image along a communications channel;

obtaining said encoded image transmitted along said communications channel;

reconstructing a zerotree from said encoded image;

vector quantization decoding subbands in said encoded image other than a top LL subband;

losslessly decoding said top LL subband;

reverse wavelet transforming said top LL subband and said vector quantization decoded subbands; and

outputting a decoded image from said decoded top LL subband and said decoded subbands other than said decoded top LL subband.

26. (new) The method of claim 9, wherein the VQ encoding further comprises analyzing a zerotree from a finer level of the pyramid hierarchy to a coarser level of the pyramid hierarchy to develop the zerotree insignificance prediction.

27. (new) The method of claim 9, wherein the VQ encoding further comprises developing each vector of the VQ encoding across all levels of the threshtree.

28. (new) The method of claim 9, wherein the VQ encoding further comprises defining a vector for the VQ encoding from the group consisting of a square block of coefficients and a rectangular block of coefficients.

29. (new) The method of claim 9, further comprising analyzing a plurality of vectors in the threshtree, the analyzing of each vector of the plurality of vectors comprising:

determining a descendent cost as a cost of all descendents of a current vector;

determining an alternate descendent cost as a cost of all descendent of the current vector if all descendents of the current vector are considered to be zerotree children;

determining a significant vector cost as a combination of the descendent cost and a cost of the current vector;

determining an isolated zero cost as a combination of the descendent cost and a cost of coding the current vector as an isolated zero;

determining a zerotree cost as a combination of the alternate descendent cost and a cost of coding the current vector as a zerotree root;

symbolizing the current vector as the zerotree root if the zerotree cost is less than the isolated zero cost and less than the significant vector cost;

symbolizing the current vector as the isolated zero if the isolated zero cost is less than the zerotree cost and the significant vector cost;

symbolizing the current vector as significant if the significant vector cost is less than the isolated zero cost and the zerotree cost; and

redefining the cost of all descendents of the current vector to the alternate descendent cost if the current vector is symbolized as the zerotree root.

30. (new) The method of claim 29, wherein the cost of each vector of the plurality of vectors is determined by a rate-distortion trade-off.